
विट्रियस एनामेल्स और फ्रिट्स —
परीक्षण पद्धति

भाग 1 छलनी विश्लेषण

(पहला पुनरीक्षण)

Vitreous Enamels and Frits —
Method of Test

Part 1 Sieve Analysis

(First Revision)

ICS 25.220.50

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Ceramicware Sectional Committee had been approved by the Chemical Division Council.

The fineness of frit in wet or dry-milled vitreous enamels or other ceramic coatings for metals has a direct bearing on many of its properties, such as fusibility, tearing, gloss, opacity, suspension in the slip and ease of spraying. Sieve analysis is the most convenient way of ascertaining fineness.

This standard was first published in 1977. In this revision, the Committee felt a need to revise the standard with a view to update the standard based on the experience of last four decades and on the currently available data.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

*Indian Standard***VITREOUS ENAMELS AND FRITS — METHOD OF TEST****PART 1 SIEVE ANALYSIS***(First Revision)***1 SCOPE**

This standard (Part 1) prescribes methods for sieve analysis of wet-milled and dry-milled vitreous enamels.

2 REFERENCES

The standards given below contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards:

<i>IS No.</i>	<i>Title</i>
IS 460 (Part 1) : 2020	Test sieves — Specification: Part 1 Wire cloth test sieves (<i>fourth revision</i>)
IS 2717 : 1979	Glossary of terms relating to vitreous enamelware and ceramic — Metal systems (<i>first revision</i>)

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 2717 shall apply.

4 SAMPLING**4.1 General**

Representative samples of vitreous enamels shall be drawn as follows depending on whether they have been wet-milled or dry-milled.

Two methods for sampling are described. Either of these may be used for general routine purposes, but in case of a dispute Method A shall be used.

4.2 Method A**4.2.1 Wet-Milled Enamels**

Select a sample of about 100 g of slip representative of the material to be tested. Protect the samples from evaporation. Determine its water content by drying it to constant mass at a temperature not exceeding 122 °C.

Stir and pass the slip through 425 micron IS Sieve before weighing and discard the material retained on it. Weigh to the nearest 0.1 g, a sample sufficient to

contain 100 g of dry solids.

4.2.2 Dry-Milled Enamels

Select a sample representative of the material to be tested containing about 100 g of dry solids and weigh to the nearest 0.1 g.

4.3 Method B

Select a sample of slip from the mill before unloading and pass it through 425 micron IS Sieve before weighing. Discard the material retained on the sieve. The sample shall consist of 100 g of slip for wet-milled enamel or 100 g for dry milled enamel.

5 SIEVE ANALYSIS**5.1 General**

Two methods for sieve analysis are described. Either of these may be used for general routine purposes, but in case of a dispute Method A shall be used.

5.2 Method A**5.2.1 Apparatus**

5.2.1.1 Balance — of at least 500 g capacity and accurate to 0.1 g

5.2.1.2 Sieves

425 micron, 75 micron and 45 micron IS Sieves (*see* IS 460 (Part 1)). The 45 micron sieve shall be used when the fineness is such that, from a sample containing 100 g of dry solids, less than 2 g is retained on 75 micron sieve.

NOTES

1 It is recommended that the height of the sieves should be about 200 mm so that there is less possibility of flooding or splashing and they may fit properly in automatic tapping and shaking machines.

2 All sieves shall be standardized initially and after every 50 tests against a reference sieve. The correction for the sieve used in this test shall be determined by sieving tests made in accordance with **5.2.2**. Identical sample shall be sieved through the reference sieve and the test sieve. Test material shall be chosen so that 5 percent to 10 percent of it is retained on the reference sieve. The difference between the percentages of the residues on the reference and test sieves respectively is the amount of correction which shall be algebraically added to, or subtracted from the correction for the reference sieve to obtain the final correction. The 425 micron sieve need not be calibrated.

3 For example, when comparing the reference sieve with a test sieve, should 8.5 g be retained on the reference sieve

and 7.5 g on the test sieve, the total correction for the test sieve would then be 8.5 to 7.5 or + 1.0.

5.2.1.3 Drier

A suitable means for drying the sieves and slip sample at a temperature not exceeding 122 °C.

NOTE — No drier is needed for testing dry-milled enamels.

5.2.1.4 Mechanical sieve shaker

Mechanically operated to produce both lateral and vertical motions, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve.

NOTE — If a machine shaker is to be used, the thoroughness of sieving shall be verified by comparing and calibrating with the hand method of sieving as described in 5.2.2.1.1.

5.2.2 Procedure

5.2.2.1 Wet-Milled enamel

Transfer the weighed sample to 75 micron or 45 micron IS Sieve. Wash the sample through the sieve with a gentle flow of water from a rubber hose until the water passing through the sieve appears to be clear and free from cloudiness. This usually requires 2 minutes. Exercise care to prevent any loss of sample because of splashing or overflowing. Dry the sieve with its residue until the residue easily moves about as a dry powder when the sieve is shaken. Complete the sieving and weighing operations as given in 5.2.2.1.1 and 5.2.2.1.2. Carry out the tests in duplicate.

5.2.2.1.1 Hand sieving

Hold the sieve with pan and cover attached in one hand at an angle of about 20° from the horizontal. Move the sieve up and down in the plane of inclination at a rate of about 150 times per minute, and strike against the palm of the other hand at the top of each stroke. After every 25 strokes turn the sieve about one-sixth of a revolution in the same direction. Continue the operation until not more than 0.05 g passes through the sieve in one minute of continuous sieving. Weigh the portion of the sample retained on the sieve to the nearest 0.1 g.

5.2.2.1.2 Machine sieving

If a mechanically operated sieve shaker is used, vary the time during which the sieve (with pan and cover attached) and the sample are shaken and note the length of time necessary to operate the sieve shaker in order to get the same result as that obtained with hand sieving. Calibrate the machine sieving operation in terms of hand sieving.

5.2.2.2 Dry-Milled enamel

Transfer the sample quantitatively to 75 micron or 45 micron IS sieve. Complete the sieving and weighing operations in accordance with 5.2.2.1.1 or 5.2.2.1.2 carry out the test in duplicate.

5.2.2.3 Calculation and report

Report the fineness of the enamel frit in percent by mass (to the nearest 0.1 percent) of the dry solids content of the sample retained on 75 micron or 45 micron IS Sieve. The mass in g is equivalent to percentage by mass.

5.2.2.4 Reproducibility

Results of duplicate tests shall agree within 0.5 g (or 0.5 percent by mass) of the sample. If duplicate tests do not agree within the tolerance, the results shall be rejected and two additional tests shall be carried out.

5.3 Method B

5.3.1 Balance— of at least 200 g capacity and accurate to 0.1 g

5.3.2 Sieves — 425 micron and 75 micron [see IS 460 (Part 1)]

NOTES

1 It is recommended that the height of the sieves should be about 200 mm so that there is less possibility of flooding or splashing and they may fit properly in automatic tapping and shaking machines.

2 A sieve properly cared for will have an approximate life of 500 tests. It should, however, be compared from time to time with a master standard or reference sieve. It is recommended that an extra sieve be purchased and preserved as a master standard against which all sieves in use or subsequently purchased may be standardized.

5.3.3 Container — suitable for weighing 100 g of sample

5.3.4 Drier — see 5.1.2.3

5.3.5 Mechanical Sieve Shaker — see 5.1.2.4

5.3.6 Procedure

5.3.6.1 Wet-Milled enamel

Transfer 100 g of sample of slip to 75 micron IS Sieve. Wash the sample through the sieve with a stream of gently running water, care being exercised to prevent splashing or overflowing of the sieve. Continue washing until the water passing through the sieve becomes clear and free from cloudiness. This usually requires at least two minutes. Dry the sieve with its residue until the residue easily moves about as a dry powder when the sieve is shaken. Shake the sieve in an automatic shaking and tapping machine, or by hand until no further material passes through it. This usually requires 5 minutes to 7 minutes. Transfer the residue remaining on the sieve to the balance and weigh to the nearest 0.1 g.

NOTE — It is recommended that after the sieve has dried, the residue be transferred to another sieve for shaking. The use of a second sieve minimizes the error caused by clogging when both washing and shaking are accomplished with the same sieve.

5.3.6.2 Dry-Milled enamel

Place 100 g of sample of milled enamel in a

75 micron IS Sieve and shake in an automatic shaking and tapping machine or by hand, until no further material passes through it. This usually requires 5 minutes to 7 minutes. Transfer the residue remaining on the sieve to the balance and weigh to the nearest 0.1 g.

NOTE — The end point is usually taken as the time at which not more than 0.1 g of material passes through the sieve with shaking for one minute. Some experience will indicate to the operator when the shaking operation is complete.

5.3.7 *Calculation and Report*

Report the mass in g of the residue retained on the sieve as equivalent to percentage by mass of the original slip, or dry-milled enamel sample.

5.3.8 *Reproducibility*

Results of duplicate tests shall agree within ± 0.5 g. Failure of duplicate determinations to agree within ± 0.5 g indicates the necessity to repeat the test.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Ceramicware Sectional Committee, CHD 09

<i>Organization</i>	<i>Representative(s)</i>
CSIR - Central Glass and Ceramic Research Institute, Kolkata	DR SUMAN KUMARI MISHRA (Chairperson)
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